Micro-Inverter

PLC Gateway

English

Installation-Manual

AE CONVERSION

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

THIS MANUAL CONTAINS IMPORTANT INSTRUCTIONS FOR THE AECONVERSION PLC GATEWAY THAT SHALL BE FOLLOWED DURING INSTALLATION AND MAINTENANCE OF THE GATEWAY.

CONTACT INFORMATION
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OTHER INFORMATION
Product information is subject to change without notice.

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1.0 About this Manual

This manual describes important information to follow during the installation and service of the AEConversion PLC Gateway. These instructions should always be kept within reach of the gateway.
Since the documentation is updated frequently, please visit the AEConversion website (www.AEConversion-solar.com/downloads) for the latest information.

1.1 Important Safety Information

To ensure the safe installation and service of the AEConversion Gateway, this manual uses the following types of safety symbols to indicate dangerous conditions and important safety instructions that are to be noted:

WARNING!
This indicates a situation where failure to follow instructions may be a safety hazard or cause equipment malfunction. Use extreme caution and follow instructions carefully.
NOTE: This indicates information particularly important for optimal system operation. Follow instructions closely.

Symbols to be noted:

Direct Current Supply Symbol:

⎓

Alternating Current Supply Symbol:

Ground Symbol:

Safety Instructions:
Before installing the AEConversion Gateway, please read all instructions and cautionary markings in the technical documentation about the AEConversion Micro-Inverter System and the PV monitoring equipment.

CAUTION: Perform all electrical installations in accordance with all applicable local electrical codes and the National Electrical Code (NEC), ANSI/NFPA 70.
Be aware that only qualified personnel should install or replace AEConversion PLC Gateway.
Do not attempt to repair the AEConversion PLC Gateway; it contains no user-serviceable parts. Tampering with or opening the AEConversion PLC Gateway will void the warranty.

WARNING!
Do NOT disconnect the Gateway from the installation without first removing AC power.

For damages resulting from failure to follow these instructions, we assume no liability. When installing the inverter, please note the following instructions for all assemblies and components of the system.

In order to ensure faultless and safe operation of this equipment, proper transport, expert storage, installation, operation and maintenance is required. During the operation of this equipment, certain equipment parts carry hazardous voltages that can cause serious injury or death. Always follow the following instructions to minimize the risk of injury or death.

1.2 Scope

This manual applies to the AEConversion PLC Gateway.

1.3 Target Audience

This manual is for the installer of the products listed in 1.2.

NOTE:
This guide assumes knowledge corresponding to a recognized professional qualification as an electrician and only qualified personnel should install or replace the AEConversion PLC Gateway and the AEConversion Micro Inverters.

WARNING!
These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that specified in the operating instructions unless you are qualified to do so.

2.0 Storage and Transportation

For storage and transport, the following warnings are to be noted:

- All contacts should be kept dry and clean!
- Transport the Gateway only in the given packaging.

2.1 Assembly, Installation, Operation and Maintenance

The following warnings must be observed:

Before installing or using the AEConversion PLC Gateway and the AEConversion Micro-Inverter, please read all instructions and note the threats, warnings, and precautions.

- **WARNING!**
  Proper grounding, wire sizing and appropriate short-circuit protection must be provided to ensure safe operation.
- Never remove the solar generator from the inverter, while it is connected to the electricity network.
- Make sure that before carrying out inspections and maintenance, the inverter is disconnected from the mains supply and is secured against restarting.
- **CAUTION:**
  Perform all electrical installations in accordance with the safety regulations all applicable local electrical codes and the National Electrical Code (NEC), ANSI/NFPA 70.
- Connect the AEConversion Micro-Inverter to the electricity network only after receiving prior approval from the electrical utility company.
- The electrical connection to the central building shall be performed only by a licensed electrician.
- If you mount the inverter at high altitude, avoid possible falling risks.
- Do not plug electrically conductive parts into the plugs and sockets! Tools and working conditions must be dry.
- Do not under any circumstances interfere with or manipulate the inverter or any other parts of the system; it contains no user-serviceable parts. Inappropriate alterations can cause damage! Tampering with or opening the AEConversion PLC gateway will void the warranty.
- The installation shall be done according to the wiring methods and wire diameters in accordance with the National Electrical Code (NEC), ANSI/NFPA 70. For Connection schemes refer also pages 12 /13.
- The voltage in grids at IT configuration shall not exceed 240V AC!

- **NOTE:**
  For changing the internal fuse resistor inside the gateway it must be sent to AEConversion for service. There are no serviceable parts inside. The integrated fuse (R65 CRF253-4 5 T 10R Vishay) is not allowed to be change.
- Do not connect the gateway and the inverter to grids without an earthed neutral conductor.

2.2 Label

The label is located on the top side of the inverter. The information on the label includes technical data, type and serial number of the device as well as safety instructions.

3.0 Notes on Liability, Warranty and Service

Remarks on liability, warranty and service are listed hereafter.

3.1 Guaranty and Warranty

AEConversion grants an implied warranty of 2 years to the inverter from date of purchase. For warranty questions, please contact your retailer or installer. If your device has a defect or malfunction during the warranty period, please also contact your retailer or installer.

Warranty claims are excluded for:

- alterations or repairs to the device
- opening of the device, for example by unscrewing the cover
- improper use of device
- improper and non-standard installation
- improper operation
- operating the equipment with defective safety devices
- impact of foreign objects and force majeure (lightning, surge, storm, fire)
- inadequate or nonexistent ventilation of the device
- disregarding of safety regulations
- shipping damage

3.2 Intended use and liability

The AEConversion PLC Gateway is intended for use in combination with the INV250-45 PLC/ INV350-60 PLC/ INV350-80 PLC/ INV500-80 PLC, which use the AC wiring to communicate. The AEConversion PLC Gateway provides the connection between the inverters to the

utility grid. But furthermore, the gateway builds the connection between the PLC bus system, which uses the AC lines to communicate, and the RS-485, needed to monitor the system.
Any other or additional use is considered improper. The manufacturer / supplier shall not be liable for any resulting damages. The risk is carried solely by the operator.
Intended use also includes compliance with the instructions and installation manual. The Gateway shall be operated with a permanent connection to the power network.

Changes to the gateway are generally prohibited. For any changes in the system a qualified electrician must be called in.

3.3 Service

We have already set high standards in the development phase on the quality and longevity of the gateways. In spite of all quality assurance activities, disturbances may occur in exceptional cases. In these cases, you will get the maximum possible support to eliminate the problem quickly and without bureaucratic complexities. Please contact our service department directly.
AEConversion Service Phone: +49 (0) 2927 - 9194 - 777

In order for the service department to respond quickly and correctly, the following information is absolutely necessary.

1) Details of the gateway:
Product description, type and serial number of the inverter; this information can be found on the label on the device.
Short description of the error:
- Did the fault occur immediately at the start or at a later time?
- Is the fault is reproducible or occurs only sporadically?
- What environmental conditions (radiation) were present at the time of the error?

2) Information about the PV-installation
- How many Powerline Micro-Inverters are installed in the system?
- What AC nominal voltage is used?

3.4 Scope of Delivery

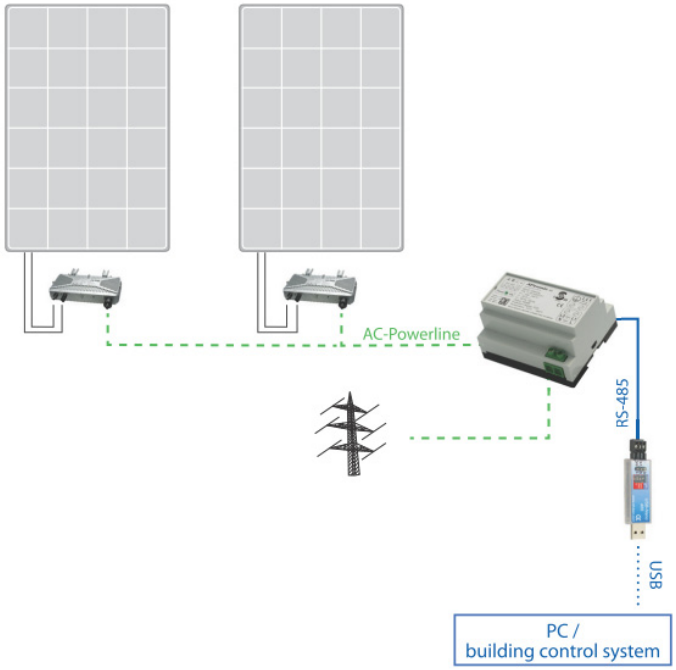
The package includes:
- Gateway
- Two wall mounting tabs and screws
- Quick Start Guide and further information on CD

4.0 Product Description

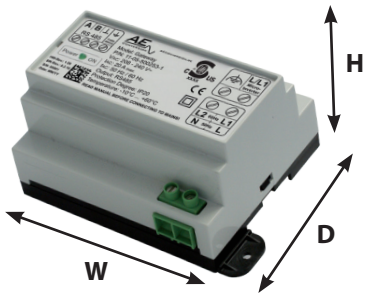
The AEConversion PLC Gateway provides the connection between inverts and the utility grid. But furthermore, the gateway builds the data exchange connection between the PLC bus system, which uses the AC line to communicate, and the RS485, needed to monitoring the system. The performance data is only transferred from the PLC bus system to RS485 and not saved.

The Powerline, originating from the micro-inverters, is converted into a RS-485 connection at the gateway which can then be connected to a standard PC or Laptop using an RS485-USB Interface adapter. While the adapter is connected to the PC or Laptop, momentary and cumulative performance data can be viewed and analyzed for the entire system, as well as for each inverter individually. With this system, a cost-effective and reliable monitoring solution is provided.

With using these gateways, it is possible a build a system with up to 128 inverters, depending on system configuration, safety equipment and a maximum distance of 100 meters between the gateway and the inverters. Since this form of communication provides monitoring on a modular level, each inverter offers an individual address code for distinctive data interchange. These address codes can be viewed using the AP Solar, to easily identify and locate a specific micro-inverter in a PV-system.

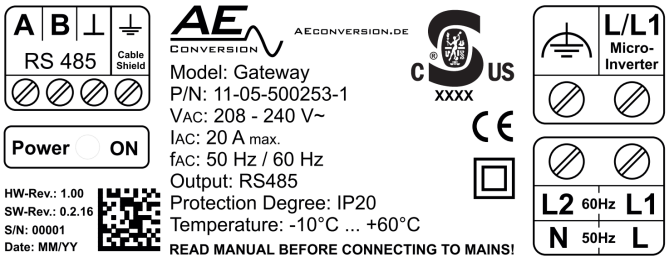


4.1 Dimensions



Model	Width [mm]	Height [mm]	Depth [mm]
AP PLC Gateway	105	89	59

4.2 Connections of the AP PLC Gateway



A	RS485: This is a data line. It is connected to an "A" connection (for example to the USB-RS485 Interface Adapter).
B	RS485: This is a data line. It is connected to a "B" connection (for example to the USB-RS485 Interface Adapter).
⊥	Earth Conductor
⏚	Cable Shield
⏚	Functional Earth
L/L1 Micro Inverter	This is the supply line to the respective inverter group (AC circuit branch). This wire is to be connected to the phase of the inverters.
L/L1	50Hz/60Hz This is the phase of the network connection. This wire is to be connected with a pole of the circuit breaker.
N/L2	50Hz/60Hz This is the common neutral. This wire is to be connected to the neutral of the inverter and the second pole of the circuit breaker.

4.3 LED-Light

The LED-Light indicates the operation status of the gateway. The power supply is working properly when the light continuously illuminated.

4.4 Protection Concepts

The following monitoring concepts and protection plans are included in the AEConversion PLC Gateway:

2004 / 108 /EC: Directive on electromagnetic compatibility
according to: DIN EN 61000-6-1, DIN EN 61000-6-2, DIN EN 61000-6-3, DIN EN 61000-6-4, DIN EN 61000-3-2, DIN EN 61000-3-3
Concerning: interference resistance, transient emissions, circuit feedback for device types <16A

2006 / 95 / EC: Directive on electrical equipment designed for use within certain voltage limits
according to:
IEC55011B: EMC
IEC 60950 / UL60950: Safety
EIA-485: RS485-Standard (Connection of the data cable to Superior Systems)

(ANSI/TIA/EIA-485-A-98) (R2003): Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems

5.0 Gateway Pre-Installation

The following instructions describe the aspects to be noted before the installation of the Gateway.

Before installing the AEConversion PLC Gateway, the PV system must be mounted and electrically installed. This must be done in accordance with the corresponding Micro-Inverter Manual, in compliance with all listed safety instructions.
For questions regarding the installation of the inverters, please refer to the respective micro-inverter manual.

In addition, please note the important safety information listed in 1.1 and 2.1 of this manual.

5.1 Parts and Tools Required

You may need to provide other parts and tools that could be required for installing a PV-System with gateways. These may include, but are not limited to the following:
PH1 Screwdriver
Slotted screw driver: 0.8x4.0mm

5.2 Lighting Surge Protection

Lightning does not actually need to strike the equipment or building where PV system is installed to cause damage. Often, a strike nearby will induce voltage spikes in the electrical grid that can damage equipment
Since the AEConversion Limited Warranty does not cover "acts of God" such as lightning strikes, and since lightning strikes can occur anywhere, it is best practice to install surge protection as part of any solar installation.

6.0 Installation Procedure

Please note the important safety information listed in 1.1 as well as the Assembly, Installation, Operation and Maintenance Warnings listed in 2.1.

Before installing the AEConversion PLC Gateway, the PV system must be mounted and electrically installed. This must be done in accordance with the corresponding Micro-Inverter Manual, in compliance with all listed safety instructions.

In the following section, an overview is given on how the gateway is to be installed.

Step 1 Measure AC at the Electrical Utility Connection
Step 2 Mount the Gateway
Step 3 Connect to Inverters and Grid
Step 4 Connect RS485 Bus
Step 5 Install and Start Software

6.1 Measure AC at the Electrical Utility Connection

To ensure proper system operation, measure AC line voltage at the electrical utility connection to confirm that it is within range. Acceptable ranges are shown below.

Three-phase 208 VAC
183 to 229 VAC L1 to L2 to L3
106 to 132 VAC L1,L2, L3 to neutral

Single-Phase 240 VAC
211 to 263 VAC L1 to L2
106 to 132 VAC L1, L2 to neutral

NOTE:
Check the labeling on the AC Cabling to be sure that the cable matches the electrical utility service at the site. Use 208 VAC (208 VAC three-phase) Cabling at sites with three-phase 208 VAC service, or use 240 VAC Cabling at sites with 240 VAC single-phase service. Use 240 VAC cable at sites with 208 single-phase service.

Please refer to page 12 (208V) and 13 (240V) for wiring diagrams.

NOTE: The operation at grids with neutrals which are not grounded is not allowed!

6.2 Mount the Gateway

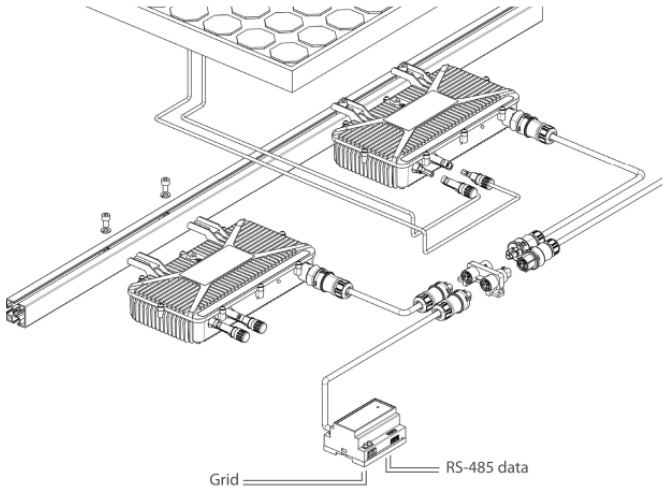
The gateway is designed to be mounted in the control cabinet with 35mm DIN rail according to EN50022. Alternatively, the housing can be mounted using the two supplied wall mounting tabs in accordance with the current installation regulations of each country.

6.3 Connect to Inverters and Grid

Please note 4.4 for explanations to the connections of the gateway.

Before installing the AEConversion PLC Gateway, the PV system, including the AEConversion Micro-Inverters must be mounted and electrically installed. This must be done in accordance with the corresponding Micro-Inverter Manual, in compliance with all listed safety instructions.

The inverter is equipped with one AC terminal on the right side of the connection area, a 20A 3-pin AC connector. The supply is phase to phase 208V or 240V depending on version. The inverters are connected using 20A 3-pin AC extension cables and distribution blocks, with one input and three outputs, to form a continuous AC power circuit. Any open AC connections must be sealed with a protective cap.

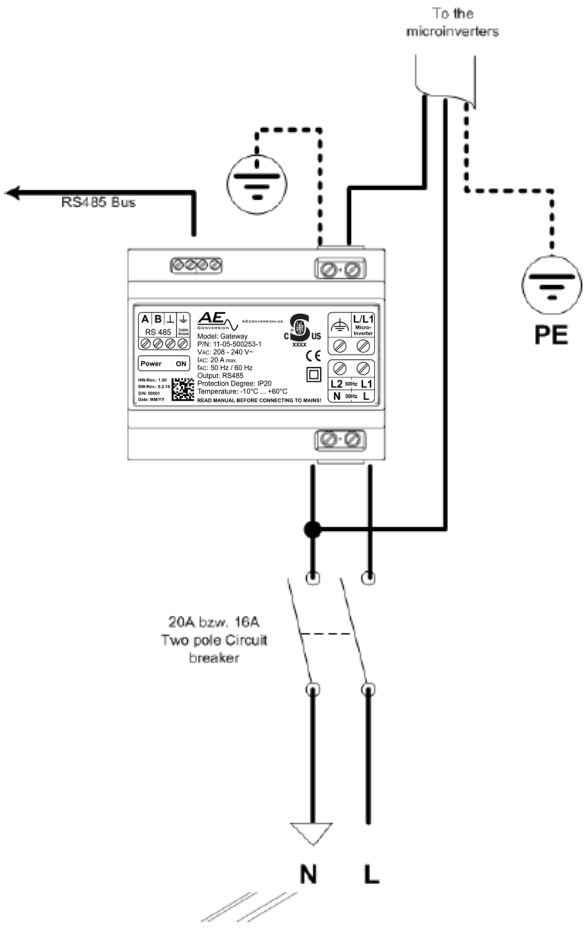


The number of micro-inverters to be connected in one power circuit (AC circuit branch) is limited by the circuit breaker. This circuit breaker acts also as a pole switch to disconnect the inverters from the mains.
For EU installations, a 16A Type B Circuit Breaker shall be installed. For US-Installations, a two pole20A Circuit breaker, e.g.Trip curve No 730-3, shall be used.
The restrictions to the maximum number of allowable units in one circuit branch are as follows:

16A circuit breaker (EU-Installations)		20A circuit breaker (US-Installations)	
Type of Inverter	Max. number of inverters in one branch	Type of Inverter	Max. number of inverters in one branch
INV250-45 EU PLC	12	INV250-45 US PLC	15
INV350-60 EU PLC	9	INV350-60 US PLC	9
INV350-80 EU PLC	9	INV350-80 US PLC	9
INV500-80 EU PLC	6	INV500-80 US PLC	8

The number of inverters that can be connected to one gateway are limited in the same way. Therefore, one AC circuit branch with one Circuit breaker can be connected to one gateway and each additional circuit needs an additional gateway. If possible, break down the group into multiple phases.

Connection Schematic for Gateway:



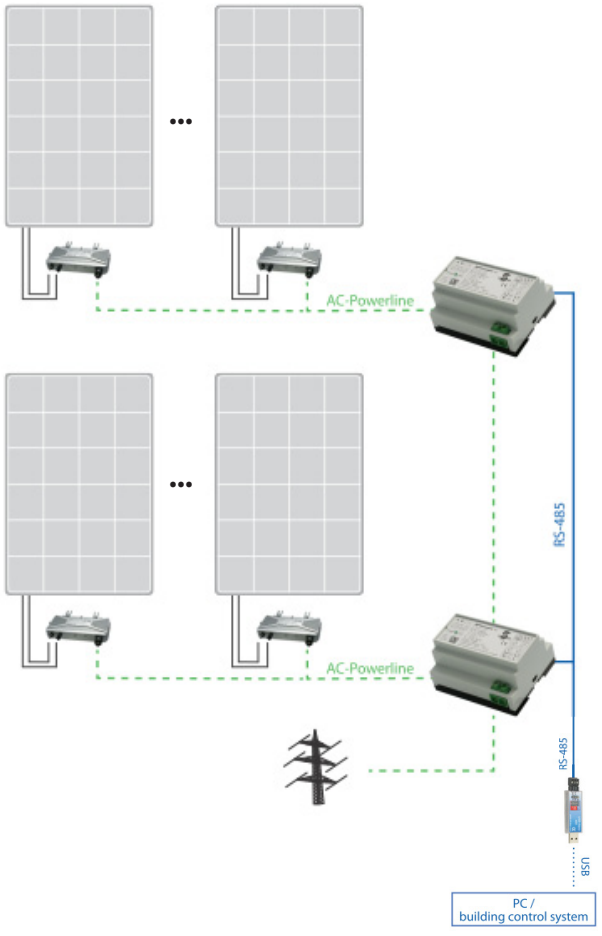
Connect the AC circuit branch of one inverter group to L/L1 (Micro Inverter) as the supply line to the gateway and connect functional earth.

For L/L1 (50Hz/60Hz to mains): This is the phase of the network connection. This wire is to be connected with a pole of the circuit breaker.
For N/L1 (50Hz/60Hz to mains): This is the common neutral. This wire is to be connected to the neutral of the inverter and the second pole of the circuit breaker.

6.4 Connect RS485 Bus

For the RS485 connection: Connect the data lines for A and B respectively, for example to the USB-RS485 Interface Adapter, and also connect the Earth Conductor and the Cable Shield. The cable shield between each subscriber should only be connected on one side to prevent unwanted potential equalization, which could degrade the communication quality up to impossible communication.

For connecting multiple gateways:
The AEConversion PLC Gateways are connected to a bus master (e.g. USB-RS485 Interface Adapter) and the bus is standardized according to ANSI/TIA/EIA-485-A-9. This means, for connecting multiple gateways, connect the A and B of one gateway to the A and B of the next and so on. The last gateway is then connected respectively from A and B of the gateway to A and B of the bus master (here: USB-RS485 Interface Adapter).



6.5 Install and Start Software

When the system is energized, please install the software on your personal computer or laptop to ensure proper operation of the system.

Insert the included CD-ROM in your CD / DVD drive. It will automatically open the installation program, which will guide you through the installation.

For direction on how to properly install and use the software, please refer to the Software User Manual.

7.0 Troubleshooting

If for any reason the Gateway is not working properly, check if the following points:

- Is the LED still lit? If the LED is not illuminated, then the power supply to the gateway could be a source of the problem
- Are all connections preformed properly? Are connections A and B done correctly?

Adhere to all the safety measures described throughout this manual. Qualified personnel can use the following troubleshooting steps if the PV system does not operate correctly.

WARNING!
Do not attempt to repair the AEConversion PLC Gateway or the AEConversion Micro-Inverter; it contains no user-serviceable parts. If it fails, please contact APtonics' Service Department to assist.

WARNING!
Be aware that only qualified personnel should troubleshoot the PV array, AEConversion Micro-Inverter or the AEConversion PLC Gateway.

WARNING!
Never disconnect the DC wire connectors under load. Ensure that no current is flowing in the DC wires prior to disconnecting. An opaque covering may be used to cover the module prior to disconnecting the module.

WARNING!
Always disconnect AC power before disconnecting the PV module wires from the AEConversion Micro-Inverter. The AC connector of the first Micro-Inverter in a branch circuit is suitable as a disconnecting means once the AC branch circuit breaker in the load center has been opened.

WARNING!
Open all ungrounded conductors of the circuit to which it is connected.

7.1 Troubleshooting a Communication-System

WARNING!
Be aware that only qualified personnel should troubleshoot the PV array, AEConversion Micro-Inverter or the AEConversion PLC Gateway.

To troubleshoot an inoperable Communication-System, follow the steps in the order shown:

1. Verify the connection to the utility grid. Make sure that the utility frequency and voltage are within allowable ranges listed in the Technical Data section in the appendix of this manual.
2. Make sure that the utility power is present at the inverter in question by first removing AC and then DC power. Do NOT under any circumstances disconnect the DC wires while the Micro-Inverter is producing power.
3. Check the AC distribution blocks between all the Micro-Inverters. Check that each inverter is energized by the electricity network as described in the previous step.
4. Any AC disconnects need to be checked if they are operating correctly and closed.
5. Check to see if the PV module DC voltage is within the allowable range shown in the Technical Data in the appendix of this manual.
6. Verify that the DC connections between the Micro-Inverter and the PV module are connected properly.
7. If the problem persists, please call customer support at AEConversion.

7.2 Other Faults

Other faults are reported to the AP-Solar Software. Refer to the AP-Solar Installation and Operation Manual for troubleshooting procedures.

8.0 Further Information

The following sections provide further guidance to the inverter.

8.1 Disposal

Dispose of the packaging in accordance with generally applicable laws and regulations. Keep the environmental requirements for recovery, reuse and disposal of materials and components.

8.2 Care

The Gateway should generally be kept free of dust and dirt.

8.3 Laws, Regulations and Technical Rules

In preparing the current solar technology systems for the respective country laws and regulations are to be noted for country, federal, European, and international levels.
The generally accepted engineering standards considered to apply, which are usually formulated in the form of standards, guidelines, rules, regulations and technical rules of state and federal agencies, utility companies, and professional associations and committees for the relevant department.
Through the installation of solar panels / solar system, the requirements for roofing, waterproofing and exterior wall cladding according to the rules of the German Roofing Trade, or equivalent national and international guidelines and standards are to be considered.
An examination of stability, the thermal protection and the aging behavior is required for retrospective installation.
To comply with the regulations on accident prevention, the use of safety systems (safety belt, scaffolding, arresting gear, etc.) may be required. These security systems are not included and must be ordered separately.
The installation must be performed by professionally qualified and authorized personnel with an approved training certificate (by a state or national organization) for the respective department.
Inside the Gateway, there are NO serviceable or exchangeable parts. The inverter may neither be opened by the customer nor the system installer.

FCC Compliance
This equipment has been tested thru FCC part 15 Class B. The unit complies with the defined standard.
During the unit is under influence of strong electric fields the unit may be disturbed. This may cause lost messages.

Tested for IT power distribution system.

9.0 Technical Data

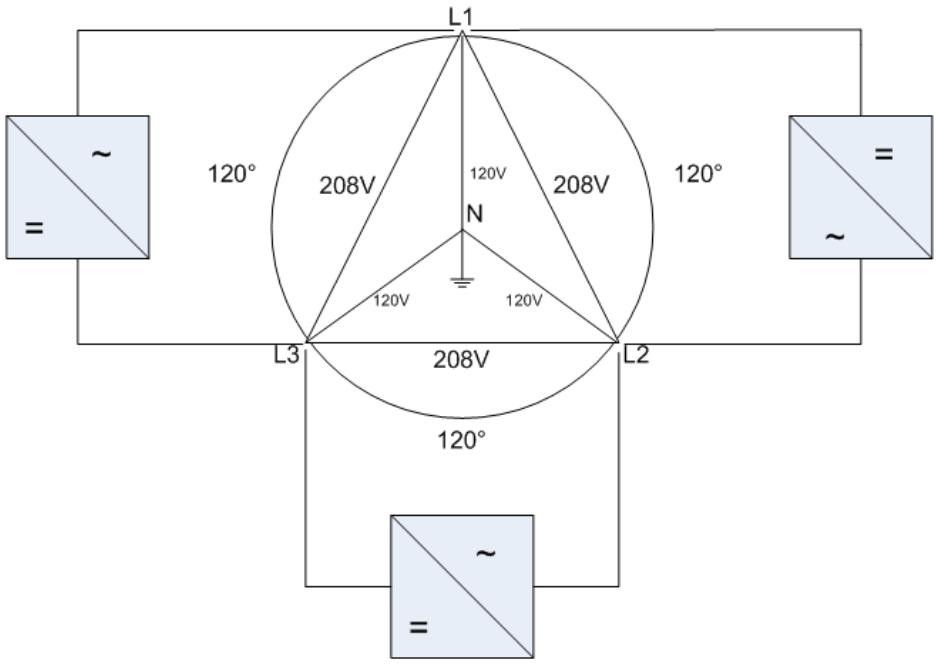
See page 14 for technical data of the Gateway.

Wiring Diagrams 208V

NOTE:
The operation at grids with neutrals which are not grounded is not allowed!

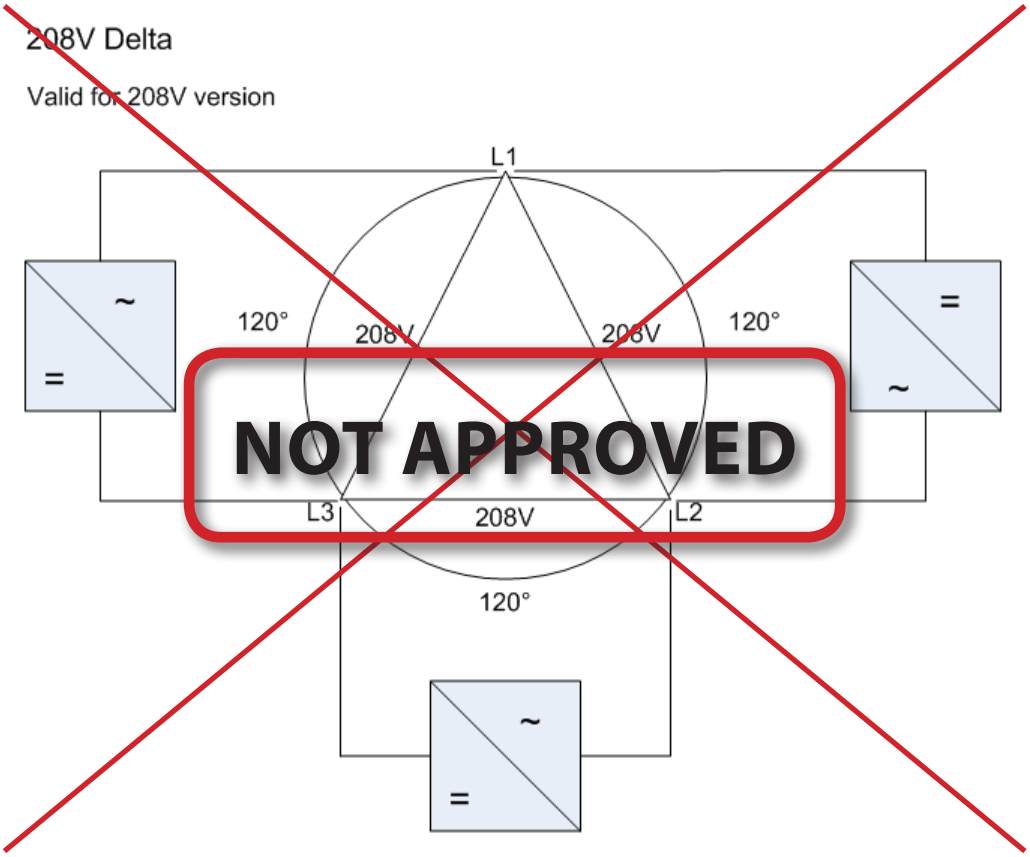
208V Delta: 120 V WYE

Valid for 208V version



208V Delta

Valid for 208V version

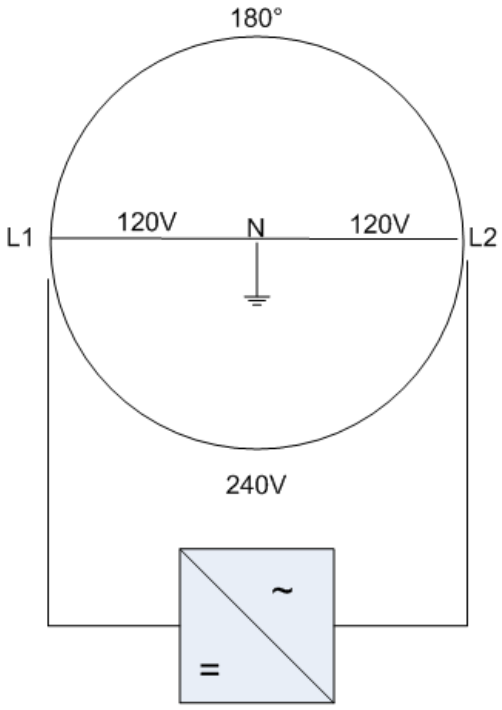


Wiring Diagrams 240V

NOTE:
The operation at grids with neutrals which are not grounded is not allowed!

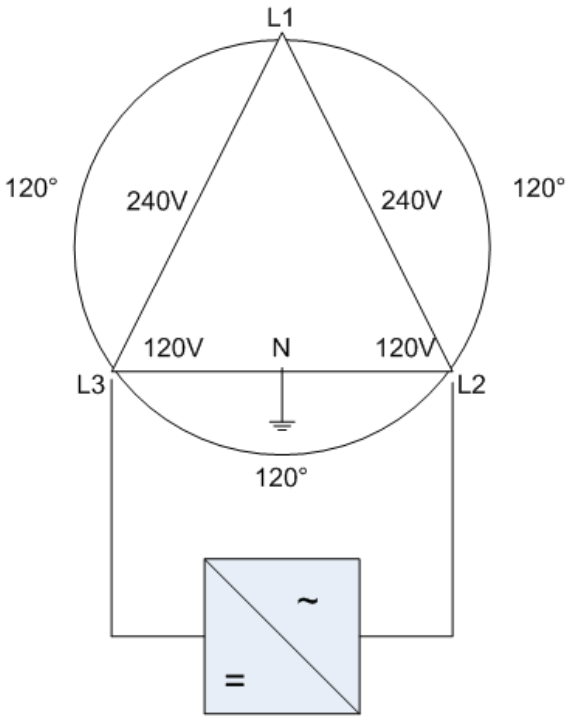
240V 120V Split phase

Valid for 240V version



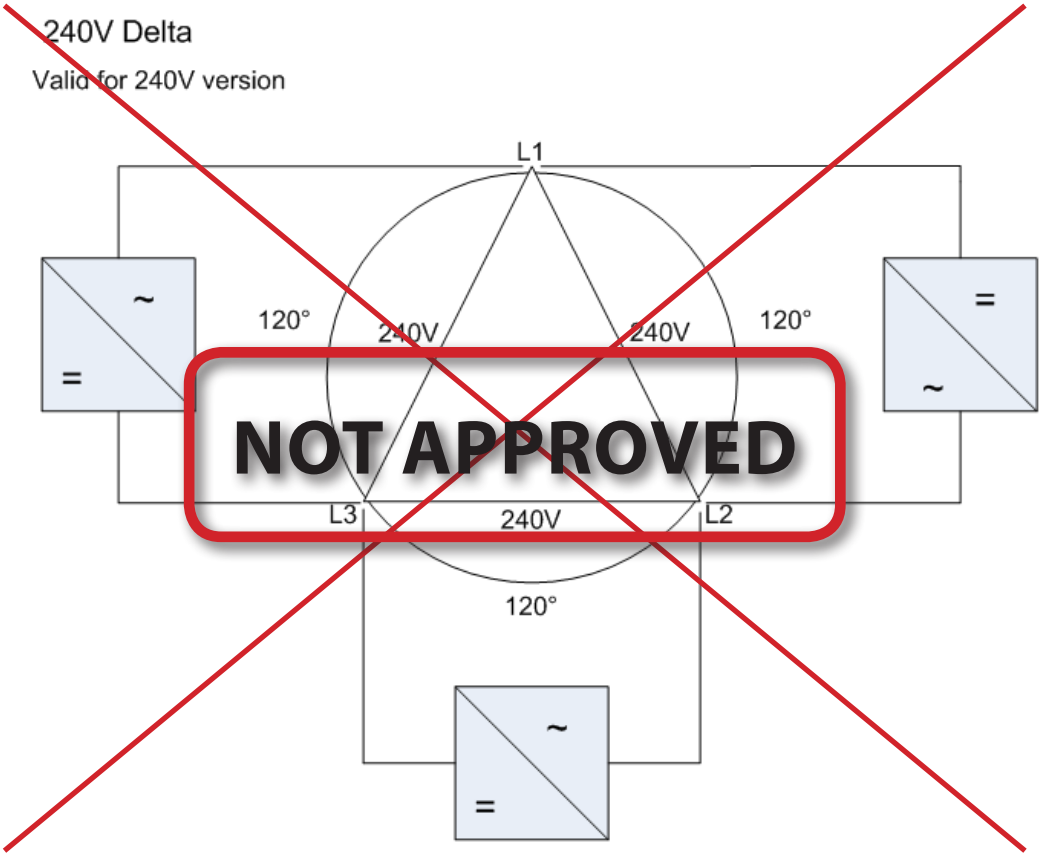
240V 120V Stinger

Valid for 240V version



240V Delta

Valid for 240V version



Gateway
for Micro-Inverter PLC

AE CONVERSION

Description

The AEConversion Gateway is a small device that is connected to up to 20 Microinverter, depending on technical specifications. It provides the Aptronic PLC-Communication interface for the Microinverter INV350-PLC and a standard RS485 Interface for remote monitoring.

Input

· Nominal AC voltage: 230V
· Nominal AC voltage range: 184V ... 264V
· AC voltage: 25mA
· AC Frequency: 50Hz / 60Hz
· Maximum AC Power: 6W
· Maximum Current: 20A

Mechanical Data

· Safety Standards: Safety Class II
· Productsafety:
· EMC: FFC Part 15 Class B
· Temperature: -25˚C ... + 60˚C
· Atmospheric humidity: 5% - 100%, noncondensing

Housing

· 100 x 65 x 90 (B x T x H)
· Weight: 0.3kg
· Protection Degree: IP 20 Class I to DIN EN60529

The PV-Inverter of Tomorrow ... Today!

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